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ABSTRACT:

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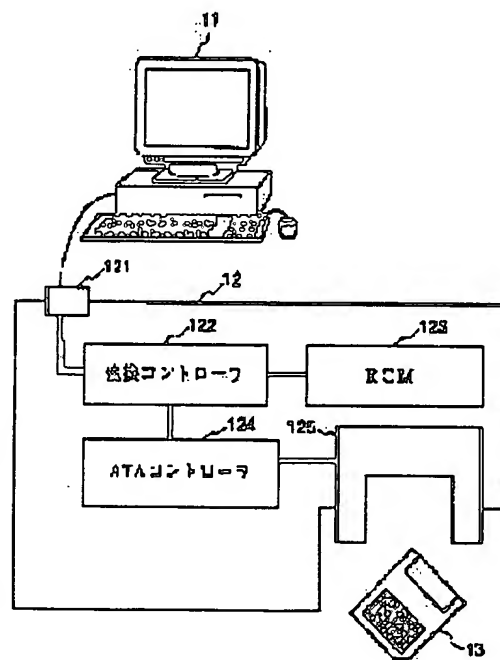
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(54) COMPUTER SYSTEM, STORAGE DEVICE, CONVERSION SYSTEM AND STORAGE MEDIUM

(57)Abstract:

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**CLAIMS**


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**[Claim(s)]**

[Claim 1] It is the computer system which consists of a computer and external storage. Said computer Have a serial interface terminal and this serial interface terminal is minded. The command based on the serial communication specification for accessing said external storage is published. Said external storage A storage and the serial interface terminal connected to the serial interface of said computer, A conversion means to change the command based on said serial communication specification serially supplied through said serial interface terminal into the command with which the parallel based on a parallel telecommunications standard corresponds, The computer system characterized by having the access means which carries out the access control of said storage based on the parallel command supplied from said conversion means.

[Claim 2] It is the computer system according to claim 1 which said computer publishes the command based on USB (Universal Serial Bus) specification, and the conversion means of said external storage changes the command based on said USB specification into the corresponding parallel command based on ATA specification, and is characterized by what said access means does for the access control of said storage based on the parallel command supplied from said conversion means.

[Claim 3] The storage of the computer characterized by to have a conversion means change the command based on the 1st specification which is constituted possible [ connection with the serial-communication terminal of a computer ], and is serially supplied from a computer into the command with which the parallel based on the 2nd different specification from said 1st specification corresponds, and the access means which carry out the access control of the storage based on the parallel command based on the 2nd specification supplied from said conversion means.

[Claim 4] It is the storage according to claim 3 which said 1st specification is USB (Universal Serial Bus) specification, and is characterized by what said 2nd specification is ATA (AT Attachment) specification.

[Claim 5] Said conversion means includes a means to change into the parallel data of the format based on the 2nd specification a format of the data serially supplied based on the 1st specification from said computer. Said access means answers the light command based on the 2nd specification supplied from said conversion means. It has the means which writes the data of the format based on the 2nd specification in said storage. Further said access means The lead command based on the 2nd specification supplied from said conversion means is answered. Said conversion means is supplied in the format which read the data memorized by said storage and was based on the 2nd specification. Said conversion means Storage according to claim 3 or 4 characterized by what the data supplied from said access means are changed into the serial data of the format based on the 1st specification, and a means to supply said computer is included for.

[Claim 6] About the command which can answer said computer, said conversion means, without using said access means among the commands supplied from said computer A response is returned to said computer, without changing this command into the command based on the 2nd specification. It is the storage according to claim 3, 4, or 5 characterized by what it changes into the command based on the

2nd specification, and is supplied to said access means about a thing [ need / among the commands supplied from said computer / said storage by said access means / to be accessed ].

[Claim 7] It is storage given in claim 3 which is equipped with a wearing means to equip with said storage removable, and is characterized by what said access means accesses said storage with which said wearing means was equipped for thru/or any 1 term of 6.

[Claim 8] It is storage given in claim 3 which is equipped with a wearing means to equip with said storage removable, and is characterized by what said access means is arranged for in said storage with which said wearing means was equipped thru/or any 1 term of 6.

[Claim 9] Said storage is storage according to claim 7 or 8 which is equipped with a flash memory and characterized by what said external storage functions as a magnetic disk drive similarly substantially.

[Claim 10] The 1st node based on serial communication specification, and the 2nd node based on a parallel telecommunications standard, The command based on the serial communication specification serially supplied through said 1st node A conversion means to change this command into the command with which the parallel based on a parallel telecommunications standard corresponds, and to output it to said 2nd node when it is the command which needs access to the equipment based on a parallel telecommunications standard, The command based on the serial communication specification serially supplied through said 1st node Conversion system characterized by having a transmitting means to transmit the response to this command through said 1st node, without changing this command into the command based on a parallel telecommunications standard when it is the command which does not need access to said equipment.

[Claim 11] It is the conversion system according to claim 10 characterized by what said serial communication specification is USB specification, said parallel telecommunications standard is ATA specification, and said equipment consists of storage based on ATA specification for.

[Claim 12] A means for said conversion means to change a format of the data based on said serial communication specification supplied through said 1st node into the data of the format based on a parallel telecommunications standard, and to output to said 2nd node, A means to change into the data of the format based on said serial communication specification a format of the data based on the parallel telecommunications standard supplied through said 2nd node, and to output it to said 1st node, Conversion system according to claim 10 or 11 characterized by preparation \*\*\*\*\*.

[Claim 13] It is the conversion system according to claim 10, 11, or 12 characterized by what said 1st node is for connecting with the serial communication terminal based on said serial communication specification of a computer, and said 2nd node is connected to an access means to access a storage based on the command supplied from said conversion means for.

[Claim 14] It is the conversion system according to claim 13 which said 2nd node is connected to said access means fixed, and is characterized by what said access means is connected to a means to access the storage with which it is equipped removable for.

[Claim 15] It is the conversion system according to claim 13 which said 2nd node is connected to said access means removable, and is characterized by what said access means is in the condition connected to said 2nd node, and said storage is accessed for.

[Claim 16] The memory which memorized the program for said conversion means and said transmitting means to answer the program for changing the command of USB specification into the command of ATA specification, and the command of USB specification, By receiving the command supplied through said 1st node, and executing the program corresponding to the received command the processor which performs conversion of a command, or the response to a command -- since -- conversion system given in claim 10 characterized by being constituted thru/or any 1 term of 15.

[Claim 17] The record medium which memorized the program for making a processor perform processing which changes the command of USB specification into the command of ATA specification, processing which answers the command of USB specification, processing which changes a format of the data of USB specification into the data of a format of ATA specification, and processing which changes a format of the data of ATA specification into the data of a format of USB specification.

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[Translation done.]

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the technique which makes external storage of the conventional ATA specification accessible by the command of USB specification about the serial interface technique of a computer.

[0002]

[Description of the Prior Art] As conventional external storage, a floppy disk drive unit, a hard disk drive unit, etc. based on ATA (AT Attachment) specification are known. These stores had the problem that it was weak from the outside to the MAG, and stored data was easy to be lost. Moreover, as storage of the terminal of pocket molds, such as PDA (Personal Data Assistance) which operates with a dc-battery, since power consumption was large, there was a problem that it could not be used.

[0003] In order to solve these problems, the technique which treats the memory card using nonvolatile memory, such as a flash memory, like a magnetic disk drive, and records and reproduces data is put in practical use.

[0004]

[Problem(s) to be Solved by the Invention] However, since the conventional external storage minded SCSI (Small Computer Serial Interface) which is a parallel interface, there were many pins of a connection connector, and the connector enlarged it, and it had the problem that reservation of the arrangement location of a body and the connector of each external storage became difficult. In order to solve this problem, from a computer, changing a command into parallel and processing a command within delivery and an external device, is also considered serially. For example, the command of SCSI conformity is transmitted serially and it is possible to change into parallel and to process within external storage. However, it is necessary to change the processing of the command of a computer itself with the existing thing, and is not practical in this case.

[0005] Moreover, recently, the serial interface of USB (Universal Serial Bus) specification is proposed, and the computer equipped with the input/output port based on this specification is also put in practical use. If this specification I/O is used, the preservation and read-out of data to external storage can be performed at a high speed. Therefore, transmitting and receiving data among these cards using USB is expected. However, by USB and SCSI, since a command system completely differs from a protocol, there is a problem of it becoming impossible to use the external storage of the SCSI conformity which is the hardware and software property from the former.

[0006] Moreover, as a feeder of external storage, there is a problem that the object for SCSI, the object for USB, and two kinds of systems must be offered.

[0007] In addition, in communicating between not only external storage but a computer, and its peripheral device, the same problem occurs.

[0008] It aims at offering the system and approach of enabling a high-speed communication link between a computer and a peripheral device, this invention having been made in view of the above-mentioned actual condition, stopping the occupancy area of the terminal on a computer, and using the



existing property effectively. Moreover, this invention sets it as other objects to offer the technique which makes it possible to control a peripheral device by the command based on USB specification, maintaining compatibility with the existing property. Moreover, this invention sets it as other objects to offer the high peripheral device of versatility.

[0009]

[Means for Solving the Problem] In order to attain the above-mentioned object, the computer system concerning the 1st viewpoint of this invention It is the computer system which consists of a computer and external storage. Said computer Have a serial interface terminal and this serial interface terminal is minded. The command based on the serial communication specification for accessing said external storage is published. Said external storage A storage and the serial interface terminal connected to the serial interface of said computer, A conversion means to change the command based on said serial communication specification serially supplied through said serial interface terminal into the command with which the parallel based on a parallel telecommunications standard corresponds, It is characterized by having the access means which carries out the access control of said storage based on the parallel command supplied from said conversion means.

[0010] According to such a configuration, since a computer communicates with a serial interface terminal, it can make terminal area small as compared with the case where a parallel interface is used, and can make occupancy area of the connector on equipment small. Moreover, by changing into the command based on a parallel telecommunications standard the command which was based on the parallel telecommunications standard and based on serial communication specification, said usual external storage can access the existing usual external storage as it is, and can maintain compatibility with existing equipment. A computer is not limited to a desktop computer, a notebook computer, etc., but contains the thing at large which accesses external storage, such as PDA (personal data reed stance), a palmtop computer, a digital still camera, and a cellular phone, and performs data processing.

[0011] the command for example, based on USB (Universal Selial Bus) specification in said computer -- publishing -- the conversion means of said external storage -- for example, the corresponding parallel command based on ATA specification for the command based on said USB specification -- changing -- said access means -- for example, the access control of said storage is carried out based on the parallel command supplied from said conversion means.

[0012] USB is a protocol which performs serial communication at a high speed, and the high-speed communication link of it is attained by following this specification. It becomes impossible however, to access the external storage based on the existing ATA specification only by following this telecommunications standard simply. Then, the command which the computer published is changed into the command based on ATA specification, and a storage is accessed. Therefore, it can have by carrying out the existing external storage based on ATA specification.

[0013] Moreover, the storage of the computer concerning the 2nd viewpoint of this invention The command based on the 1st specification which is constituted possible [ connection with the serial communication terminal of a computer ], and is serially supplied from a computer It is characterized by having a conversion means to change into the command with which the parallel based on the 2nd different specification from said 1st specification corresponds, and the access means which carries out the access control of the storage based on the parallel command based on the 2nd specification supplied from said conversion means.

[0014] According to this configuration, the communication link using the serial communication terminal of a computer is attained. Therefore, it becomes possible to stop the occupancy area of the connection of a computer small. Moreover, since the command based on the 1st specification supplied serially is changed into the command based on the 2nd specification of parallel, compatibility with the storage which carries out the access control of the storage based on the parallel command currently used widely is securable. In addition, with a computer, the thing at large which accesses a storage and performs data processing as mentioned above is included.

[0015] Said 1st specification is for example, USB (Universal Serial Bus) specification, and said 2nd specification is for example, ATA (AT Attachment) specification. USB is a protocol which performs

serial communication at a high speed, and the high-speed communication link of it is attained by following this specification. Moreover, most existing external storage is based on ATA specification. Therefore, compatibility with the existing storage is maintainable by changing into the command based on ATA specification the command which the computer published, and accessing a storage.

[0016] Said conversion means may also include a means change into the parallel data of the format based on the 2nd specification a format of the data serially supplied based on the 1st specification from said computer, and said access means may answer the light command based on the 2nd specification supplied from said conversion means, and may be equipped with the means which writes the data of the format based on the 2nd specification in said storage. Moreover, said access means answers the lead command based on the 2nd specification supplied from said conversion means. Said conversion means is supplied in the format which read the data memorized by said storage and was based on the 2nd specification. Said conversion means You may change into the serial data of the format based on the 1st specification the data supplied from said access means, and may also include a means to supply said computer. By considering as such a configuration, not only a command but the compatibility of data is securable.

[0017] About the command which can answer said computer, said conversion means, without, for example, using said access means among the commands supplied from said computer A response is returned to said computer, without changing this command into the command based on the 2nd specification. About a thing [ need / among the commands supplied from said computer / said storage by said access means / to be accessed ], it changes into the command based on the 2nd specification, and said access means is supplied. What can be processed uniquely exists [ the command to be processed and conversion means by the access means ] in the command supplied from a computer. According to this configuration, about the command which can process a conversion means, when a conversion means processes directly, the response time can be shortened.

[0018] It has a wearing means to equip with a storage removable, and you may make it access the storage with which it was equipped. Under the present circumstances, an access means is also in that with which is arranged fixed, may access the storage with which said wearing means was equipped, and is formed in a storage in storage at one, and said wearing means is equipped, and is \*\*. Moreover, said storage may be equipped with a flash memory and said external storage may function as a magnetic disk drive similarly substantially.

[0019] The conversion system concerning the 3rd viewpoint of this invention The 1st node based on serial communication specification, and the 2nd node based on a parallel telecommunications standard, The command based on the serial communication specification serially supplied through said 1st node A conversion means to change this command into the command with which the parallel based on a parallel telecommunications standard corresponds, and to output it to said 2nd node when it is the command which needs access to the equipment based on a parallel telecommunications standard, The command based on the serial communication specification serially supplied through said 1st node It is characterized by having a transmitting means to transmit the response to this command through said 1st node, without changing this command into the command based on a parallel telecommunications standard, when it is the command which does not need access to said equipment.

[0020] According to such a configuration, the communication link between the serial ports and parallel ports where command systems differ is attained through this inverter. Moreover, since the response to a command is transmitted without changing a command depending on the class of command, the response time can be shortened.

[0021] Said serial communication specification is for example, USB specification, said parallel telecommunications standard is ATA specification, and said equipment consists of storage based for example, on ATA specification.

[0022] A means for said conversion means to change a format of the data based on said serial communication specification supplied through said 1st node into the data of the format based on a parallel telecommunications standard, and to output to said 2nd node, You may have a means to change into the data of the format based on said serial communication specification a format of the data based

on the parallel telecommunications standard supplied through said 2nd node, and to output it to said 1st node. By considering as such a configuration, the communication link of data also becomes possible.

[0023] Said 1st node is for connecting with the serial communication terminal based on said serial communication specification of a computer, and said 2nd node is connected to a means to access a storage based on the command supplied for example, from a conversion means. Said 2nd node is connected for example, to the fixed target at said access means, and said access means is connected to a means to access the storage with which it is equipped removable. Such a configuration forms the controller which accesses a storage for example, in conversion system, and when accessing the removable record medium which does not contain a controller, it can apply it. Moreover, said access means is in the condition which was connected to said 2nd node removable and connected to it, and may access said storage. Such a configuration unifies the controller which accesses this storage to a storage, and when connecting with the 2nd node and accessing a storage, it can apply it.

[0024] the processor which performs conversion of a command, or the response to a command by receiving the memory which memorized a program for said conversion means and said transmitting means to answer the program for changing the command of for example, USB specification into the command of ATA specification, and the command of USB specification, and the command which are supplied through said 1st node, and executing the program corresponding to the command which received -- since -- it is constituted.

[0025] In order to attain the above-mentioned object, the program for performing the processing which changes the command of USB specification into the command of ATA specification, the processing which answer the command of USB specification, the processing which change a format of the data of USB specification into the data of a format of ATA specification, and the processing which change a format of the data of ATA specification into the data of a format of USB specification may record on a record medium, and may distribute to a processor.

[0026]

[Embodiment of the Invention] Hereafter, the storage concerning the gestalt of implementation of this invention is explained.

(Gestalt of the 1st operation)

[0027] Drawing 1 shows the configuration of the computer system concerning the gestalt of implementation of the 1st of this invention. This system is constituted more with a computer 11, the reader writer 12, and the removable memory card 13 so that it may illustrate.

[0028] A computer 11 consists of personal computers equipped with the serial interface based on USB specification etc. A computer 11 outputs and inputs various commands, control signals, and data from a USB terminal in order to process writing in data for external storage as a kind of disk unit, reading data, and eliminating by actuation of predetermined drivers, such as OS (operating system), etc.

[0029] As shown in drawing 2, a memory card 13 equips a front face with a terminal 132, and equips the interior with the flash memory 131 connected to the terminal 132. According to ATA specification, a memory card 13 functions as the so-called silicon disc or a PC card, reads and outputs the data which have memorized and memorized data according to the control from the outside, and eliminates stored data.

[0030] the serial interface (USB/F) 121 based on USB specification as the reader writer 12 was shown in drawing 1, the conversion controller 122, ROM123, the ATA (AT Attachment) controller 124, and a connector 125 -- since -- it is constituted.

[0031] USB/F121 is a node connected to a computer 11, and data are transmitted and received between computers 11 based on USB specification.

[0032] A conversion controller 122 consists of one chip microprocessors etc., operates according to the program stored in ROM123, changes into the command and the data of ATA specification conformity the command and the data of USB specification conformity which are supplied from a computer 11, outputs to an ATA controller 124, changes into the control signal and the data of USB specification conformity the control signal and the data of ATA specification conformity which are supplied from an ATA controller 124, and supplies them to a computer 11 through USB/F 121.

[0033] ROM123 memorizes the program for having memorized a program, fixed data, etc. which specify actuation of the conversion controller 122, for example, changing the command of USB specification into the command of ATA specification. The program module for changing each command into the corresponding ATA command about the command which needs to access a memory card 13 at the command of USB specification, and the command with which there is a command without the need of accessing and ROM123 needs to access a memory card 13 is memorized, and the program module for answering this command is memorized about the command which does not need to access a memory card 13. Moreover, ROM123 memorizes a program for the conversion controller 122 to change a format of the data of USB specification, and a format of the data of ATA specification mutually etc.

[0034] The ATA controller 124 is a read/write controller of ATA specification conformity, and carries out read/write of the data to a memory card 13. A connector 125 is a node which connects a memory card 13 with the ATA controller 124, and is equipped with the connection terminal connected to the slot equipped with a memory card 13 removable, and the ATA controller 124 and the terminal 132 of a memory card 13 with which it was equipped.

[0035] Next, with reference to the flow chart of drawing 3 -9, sequential explanation of the actuation of the computer system of the above-mentioned configuration is given.

[0036] (Startup processing) First, a startup of this computer 11 starts the exclusive device driver for OS starting first (step S1), then accessing the reader writer 12 under control of OS, as shown in drawing 3 (step S2). Then, a computer 11 starts suitably the program which needs others, and shifts to an initial state.

[0037] (Format of a memory card 13) In order for a computer 11 to use a memory card 13 as an external storage element, it is necessary to format a memory card 13 according to the specification of OS.

[0038] This format actuation is performed by directions of an operator. First, an operator directs a format of an aperture and a memory card 13 for the window of a device driver from the input sections, such as a keyboard and a mouse. These directions are answered, and a device driver publishes a formatting command, as shown in drawing 4 (step S11). This formatting command is a command based on USB specification.

[0039] This formatting command is transmitted to the conversion controller 122 through the USB terminal, the cable, and USB/F121 of a computer 11.

[0040] When this formatting command cannot be received for the reason of the activation middle class for a certain reason, for example, other processings, the conversion controller 122 disregards this command and does not react (steps S12 and S13).

[0041] On the other hand, the conversion controller 122 transmits an ACK (ACKnowledge) signal to a computer 11, when this formatting command can be received (steps S12 and S14).

[0042] Moreover, the conversion controller 122 distinguishes that the received command is a formatting command, reads the program module which specifies processing for the formatting command of USB conformity from ROM123, and performs format processing according to this program (step S15).

[0043] In this format processing, the conversion controller 122 publishes the FLASH READ command for the ATA controller 124. The FLASH READ command of the ATA controller 124 is carried out, and it detects a bad block. Next, the ATA controller 124 publishes the BLOCK ERASE command for all blocks of those other than a bad block, and eliminates the block of those other than a bad block. Then, the ATA controller 124 publishes the FLASH WRITE command, and writes in initialization data, such as CIS ( ).

[0044] The ATA controller 124 transmits a normal termination signal to the conversion controller 122, after a format is completed normally. Answering this normal termination signal, the conversion controller 122 outputs the normal termination signal of USB conformity to a computer 11 (step S16). The device driver on a computer 11 answers this normal termination signal, and performs predetermined processing of notifying an operator of termination of a format.

[0045] On the other hand, when a format of a memory card 13 is not normally completed according to a certain cause, as for the ATA controller 124, an abnormal termination signal is transmitted to the conversion controller 122. This abnormal termination signal is answered, and while the conversion

controller 122 outputs the abnormal termination signal of USB conformity to a computer 11, it goes into a STALL condition (step S17). In this STALL condition, the conversion controller 122 is setup. Only a stall reaction is carried out to commands other than a packet. When STALL occurs, the device driver of a computer 11 publishes the Request Sense command mentioned later, grasps the content of an error, publishes the CLEAR STALL command (CLEAR FEATURE), and is returned to an IDLE condition from a STALL condition. In addition, a format of the memory card 13 which built in the flash memory is performed to chisels, such as the time of issuance of a memory card 13, and it may not be made not to format in the reader writer 12. In this case, although the conversion controller 122 will return ACK to a computer 11 if Format Command is received from a computer 11, it does not perform actuation for a format especially after that.

[0046] (Acquisition of device information) When accessing a memory card 13 by this computer system, an external storage element is what kind of thing, or it is necessary to distinguish (a device type, the version of ISO, response data format, product ID, etc.). In this case, a system performs processing shown in drawing 5. First, a device driver publishes the inquiry (inquiry) command (step S21). This command is a serial command based on USB specification.

[0047] This Inquiry A command is outputted through USBI/F (serial interface) of a computer 11, and is transmitted to the conversion controller 122 through USBI/F121.

[0048] The conversion controller 122 is this Inquiry by a certain reason. When a command is unreceivable, this command is disregarded and it does not react (steps S22 and S23).

[0049] On the other hand, the conversion controller 122 is this Inquiry. When a command can be received, an ACK signal is transmitted to a computer 11 (step S 22 24). Moreover, information, such as the device type of this external storage beforehand stored in ROM123, an ISO version, an ECMA version, an ANSI version, response data format, additional data length, Vendor ID, Product ID, and the number of the product versions, is acquired.

[0050] The device driver on a computer 11 answers an ACK signal, and publishes the IN command for requiring acquisition of data (step S25). This IN command is transmitted to the conversion controller 122 through USBI/F121.

[0051] The conversion controller 122 transmits the device information acquired at step S24 to a computer 11, when the IN command can be executed (steps S26 and S27). If Inquiry data are received, the device driver on a computer 11 will transmit an ACK signal to the conversion controller 122 (step S28), and will end this Inquiry processing.

[0052] From the supplied data, a device driver is used, when acquiring information, such as the device type of a memory card 13, an ISO version, an ECMA version, an ANSI version, response data format, additional data length, Vendor ID, Product ID, and the number of the product versions, and accessing a memory card 13 henceforth.

[0053] On the other hand, when the IN command which was performing other processings and the computer 11 published cannot be executed, the conversion controller 122 transmits an NAK signal to a computer 11, and notifies that this command cannot be executed (steps S26 and S29).

[0054] On the other hand, when the communication link between a computer 11 and the conversion controller 122 is not normally performed by a certain cause, while outputting the STALL signal of USB conformity, it is set as a STALL condition (steps S26 and S30).

[0055] (Read-out processing) Next, the processing which reads the data memorized by the memory card 13 is explained with reference to drawing 6. In this case, a device driver publishes the Read (read-out) command based on a demand of an application program or OS (step S31). This command is a command based on USB specification including the address, the cutting tool length (byte count) amount of data, etc. of data.

[0056] This Read command is transmitted to the conversion controller 122 through USBI/F121.

[0057] For a certain reason, when this Read command cannot be received, the conversion controller 122 disregards this command and does not react (steps S32 and S33).

[0058] On the other hand, the conversion controller 122 transmits an ACK signal to a computer 11, when this Read command can be received (steps S32 and S34).

[0059] Moreover, the conversion controller 122 reads the program module which specifies the processing for changing the Read command of USB conformity into the Read command of ATA conformity from ROM123, changes the Read command of USB conformity into the Read command of ATA conformity according to this program, and supplies it to the ATA controller 124 at parallel.

[0060] The ATA controller 124 answers the changed Read command, and only the cutting tool length to whom the data memorized to the address with which a memory card 13 corresponds were directed reads it, and it is supplied to the conversion controller 122.

[0061] On the other hand, a device driver answers an ACK signal from the conversion controller 122, and publishes the IN command for requiring acquisition of data (step S35). This IN command is transmitted to the conversion controller 122 through USBI/F121.

[0062] When the IN command can be executed, the conversion controller 122 reads the program module which specifies the processing for changing the data of ATA conformity into the data of USB conformity from ROM123, changes into a format of USB conformity a format of the data of the ATA conformity supplied from the ATA controller 124 according to this program, and transmits it to a computer 11 (steps S36 and S37). If data are received, a device driver will transmit an ACK signal to the conversion controller 122 (step S38), and will end read-out processing. Thus, application or OS is provided with the acquired data, and they are used for processing.

[0063] On the other hand, when the IN command which was performing other processings and the computer 11 published cannot be executed, the conversion controller 122 transmits an NAK signal to a computer 11, and notifies that this command cannot be executed (steps S36 and S39).

[0064] On the other hand, when the communication link between a computer 11 and the conversion controller 122 is not normally performed by a certain cause, while outputting the STALL signal of USB conformity, it is set as a STALL condition (steps S39 and S40).

[0065] (Write-in processing) Next, the processing which writes in data is explained to a memory card 13 with reference to drawing 7. In this case, a demand of an application program or OS is answered and a device driver publishes the Write (writing) command (step S41). This command is a command based on USB specification including the address, cutting tool length (byte count), etc. of data.

[0066] This Write command is transmitted to the conversion controller 122 through USBI/F and USBI/F121 of a computer 11.

[0067] When this Write command cannot be received, the conversion controller 122 disregards this command and does not react (steps S42 and S43).

[0068] On the other hand, the conversion controller 122 transmits an ACK signal to a computer 11, when this Write command can be received (steps S42 and S44). Furthermore, the conversion controller 122 reads the program module which specifies the processing for changing the Write command of USB conformity into the Write command of ATA conformity from ROM123, changes into the Write command of ATA conformity the Write command of the USB conformity supplied from the computer 11 according to this program, and transmits it to the ATA controller 124. The ATA controller 124 answers the Write command of ATA conformity, and stands by reception of data.

[0069] On the other hand, a device driver answers an ACK signal from the conversion controller 122, and publishes the Out command which directs the output of data (step S45). Furthermore, the data for writing are transmitted to the conversion controller 122 (step S46).

[0070] The conversion controller 122 reads the program module which specifies the processing for changing a format of the data of (step S47) and USB conformity into a format of ATA conformity from ROM123, when the Out command can be executed, it changes into a format of ATA conformity a format of the data of the USB conformity supplied from the computer 11 according to this program, and transmits it to the ATA controller 124.

[0071] The ATA controller 124 will write in the data supplied to the memory card 13 one by one, if data are received.

[0072] If the store of data is completed, the ATA controller 124 transmits the signal which directs write-in completion to the conversion controller 122, and the conversion controller 122 will transmit an ACK signal to a computer 11 (step S48), and it will end write-in processing.



- [0073] On the other hand, when the Out command which was performing other processings and the computer 11 published cannot be executed, the conversion controller 122 transmits an NAK signal to a computer 11, and notifies that this command cannot be executed (steps S47 and S49).
- [0074] On the other hand, when the communication link between a computer 11 and the conversion controller 122 is not normally performed by a certain cause, while outputting the STALL signal of USB conformity, it is set as a STALL condition (steps S47 and S50).
- [0075] (Condition distinction (sense) processing) Next, a device driver explains the sense processing which distinguishes the condition of the reader/writer 12 containing a memory card 13 with reference to drawing 8. In this case, a device driver publishes the Sense command (step S51). The Sense command is the Mode Sense command which asks the storage capacity of a memory card 13. There are two kinds of Request Sense which asks the condition of equipment. A device driver publishes one command if needed. This command is a command of USB conformity.
- [0076] The published Sense command is transmitted to the conversion controller 122 through USB/F of a computer 11, and USB/F121.
- [0077] When this Sense command cannot be received, the conversion controller 122 disregards this command and does not react (steps S52 and S53).
- [0078] On the other hand, the conversion controller 122 transmits an ACK signal to a computer 11, when this Sense command can be received (steps S52 and S54).
- [0079] Moreover, for the conversion controller 122, the Sense command is Mode Sense. When it is a command, the program module which specifies the processing for changing the Mode Sense command of USB conformity into the Mode Sense command of ATA conformity is read from ROM123, the Mode Sense command of USB conformity is changed into the Identify Drive command of ATA conformity according to this program, and the ATA controller 124 is supplied at parallel.
- [0080] The ATA controller 124 answers the changed Identify Drive command, reads the list of parameters memorized in the predetermined location of a memory card 13, such as capacity, and supplies it to the conversion controller 122.
- [0081] On the other hand, a device driver answers an ACK signal from the conversion controller 122, and publishes the IN command for requiring acquisition of data (step S55).
- [0082] When the IN command can be executed, the conversion controller 122 reads the program module which specifies the processing for changing the data of ATA conformity into the data of USB conformity from ROM123, changes into a format of USB conformity a format of the parameter list of the ATA conformity supplied from the ATA controller 124 according to this program, and transmits it to a computer 11 (steps S56 and S57). If data are received, a device driver will transmit an ACK signal to the conversion controller 122 (step S58), and will end sense processing. Thus, application or OS is provided with the acquired data, and they are used for access of a memory card 13.
- [0083] Moreover, the Sense command is Request Sense. When it is a command, the conversion controller 122 reads the program module which specifies the processing for changing the Request Sense command of USB conformity into the Identify Drive command of ATA conformity from ROM123, changes the Request Sense command of USB conformity into the Identify Drive command of ATA conformity according to this program, and supplies it to the ATA controller 124 at parallel.
- [0084] The conversion controller 122 and the ATA controller 124 check each part in equipment, and collect the sense key data in which the condition of each part is shown. As a content of sense, there are whether it is accessible in whether an error exists in memory, whether an unrecoverable error exists, whether a hardware error exists, and whether data are protected, for example. The ATA controller 124 supplies collected sense key data to the conversion controller 122.
- [0085] On the other hand, when the IN command which the computer 11 published cannot be executed, the conversion controller 122 transmits an NAK signal to a computer 11, and notifies that this command cannot be executed (steps S56 and S59).
- [0086] On the other hand, when the communication link between a computer 11 and the conversion controller 122 is not normally performed by a certain cause, while outputting the STALL signal of USB conformity, it is set as a STALL condition (steps S56 and S60).

[0087] (Insert and remove of a memory card 13) The ATA controller 124 will distinguish that, if the insert and remove of the memory card 13 to a connector 125 are checked periodically and insert and remove are performed, in order to enable plug-and-play processing by OS. and the computer 11 -- the conversion controller 122 -- minding -- a connoisseur -- when there is an inquiry, a distinction result is notified through the conversion controller 122 by interruption transfer mode (Interrupt Transfer Mode). OS answers this advice and starts plug-and-play processing.

[0088] (It processes at the time of Stall (abnormalities)) Next, processing when a channel (cable) changes into a Stall condition is explained with reference to drawing 9. In this case, a driver is Request Sense. A command is published (step S61).

[0089] The conversion controller 122 is this Request Sense. A command is answered and an ACK signal is transmitted to a computer 11 (step S62).

[0090] Moreover, the conversion controller 122 and the ATA controller 124 check each part in equipment, and collect the sense key data in which the condition of each part is shown. On the other hand, a computer 11 answers an ACK signal and outputs the IN command (step S63). The conversion controller 122 answers the IN command and the sense key data collected at step S62 are transmitted to a computer 11 (step S64). A device driver provides OS with the supplied sense key data, and OS is STALL. A cause is recognized and avoided (step S65). Furthermore, OS publishes the Clear STALL command through a device driver (step S66). If this command is received, the conversion controller 122 will return to an IDLE condition from a STALL condition, and will transmit an ACK signal to a computer 11 (step S67). Hereafter, the usual communication link between a computer 11 and external storage 12 is attained.

[0091] As explained above, with the gestalt of this operation, external storage can be accessed using the USB port which is the serial input/output terminal of a computer 11. Therefore, in the case of small devices [, such as a palmtop computer, PDA (personal data reed stance), a digital still camera, and a cellular phone, ], the size of a connector does not pose [ a computer ] a problem.

[0092] Moreover, since the USB command which a computer uses, and the ATA command which the conventional external storage uses are changed mutually, the conventional storage of ATA conformity can be used as it is, and compatibility with the existing system can be maintained. Moreover, since the USB interface is used, a high-speed communication link is attained.

[0093] (Gestalt of the 2nd operation) In the gestalt of the 1st and the 2nd operation, although the ATA controller 124 for controlling a memory card 13 has been arranged in the reader writer 12, an ATA controller may be arranged in a memory card 13. The configuration in this case is shown in drawing 10. In this case, except for the point that the communication link between the conversion controller 122 and the ATA controller 124 (communication link based on ATA specification) is performed through a connector 125, that actuation is the same as actuation of the gestalt of the 1st operation. Moreover, SCSI/F127 and the selector 128 of a gestalt of the 2nd operation may be arranged, and the outgoing end of a selector 128 may be connected to the ATA controller 124 in a memory card 13 through a connector 125.

[0094] (Gestalt of the 3rd operation) The reader writer 12 of the gestalt of the 1st operation is memory card 13 dedication which does not build in an ATA controller, and although the reader writer 12 of the gestalt of the 2nd operation was exclusively [ memory card 13 ] for the type having an ATA controller, it may offer the reader writer which can be shared to any memory card of a type.

[0095] An example of the configuration of this kind of reader writer 12 is shown in drawing 11. With this configuration, a sensor 133 distinguishes with what kind of memory card 13 it was equipped, and, in the case of the memory card 13 which does not contain an ATA controller, a selector 134 connects the ATA controller 124 and a connector 125 according to that distinction result. On the other hand, in the case of the memory card 13 containing an ATA controller, a selector 134 connects the conversion controller 122 and a connector 125. It cannot be based on such a configuration, then the class of memory card, but can process by this reader writer 12. The information which shows those classification is formed of opening, slitting, etc., and a sensor 133 is constituted from a photosensor, a microswitch, etc. at a memory card 13.



[0096] (Gestalt of the 4th operation) In the gestalt of the 1st thru/or the 3rd operation, although the memory card 13 was explained about the reader writer 12 removable one sheet, it is good also as removable in the memory card 13 for every plurality.

[0097] In this case, a connector 125 is equipped with two or more slots 125A and 125B as shown in drawing 12. Sensors 133A and 133B are arranged at each slot, and the signal which shows which slot is equipped with the memory card 13 is supplied to the ATA controller 124. The conversion controller 122 asks the ATA controller 124 an equipment configuration suitably. When the conversion controller 122 receives the Inquiry command from a computer 11, it notifies the equipment configuration incorporated beforehand to a computer 11.

[0098] For example based on the notified system configuration, a device (memory card 13) is specified and a computer 11 accesses it.

[0099] Moreover, it is good also as two or more unit protection arrival being possible in the memory card 13 which contained the ATA controller 124.

[0100] Furthermore, you may enable it to share the memory card 13 which builds in the ATA controller 124, and the memory card 13 which is not built in. In this case, it distinguishes which slot was equipped with which type of memory card, and it is notified to a computer 11. A computer 11 specifies the memory card 13 to access, and publishes a read/write command etc. The conversion controller 122 supplies a direct ATA command to the memory card, when the specified memory card 13 builds in a controller 124. In accessing the memory card 13 which does not build in a controller 124, it accesses a memory card 13 through the ATA controller 124 arranged in the reader writer 12.

[0101] The reader writer 12 does not need to be connected to the USB terminal of dedication. For example, as shown in drawing 13, the hub 111 connected to the USB terminal of a computer 11 into the case of display unit 11A, such as CRT, may be arranged, two or more USB terminals may be pulled out from this hub 111, and the reader writer 12 may be connected to this one. Under the present circumstances, the slots 125A and 125B of 1 or two or more connectors 125 of the reader writer 12 may be arranged on the transverse-plane soffit section of a display, a side face, etc. Similarly, connection terminal 125C of USB may be arranged.

[0102] The insert and remove of the memory card 13 can be carried out to the slot formed in such a configuration, then CRT, etc., memory can be used, and it is dramatically convenient. The handling becomes easy by supporting a plug-and-play function especially. Moreover, when a storage is a flash memory, even if CRT generates a field, especially an adverse effect is not received, but it is stabilized and the content of storage can be saved.

[0103] In addition, various limited \*\*\*\*\*, deformation, and application are possible for this invention in the gestalt of the above-mentioned implementation. For example, although the device driver which operates on OS controlled the reader writer 12 by the gestalt of the above-mentioned implementation, the OS itself may control.

[0104] Moreover, although the gestalt of the above-mentioned implementation showed the example which changes the command of USB specification, the command of data and ATA specification, and data, when changing other different serial specification and parallel specification, it can apply similarly. Moreover, this invention is not limited when controlling the external storage of a computer, but when controlling the peripheral device of a computer, it can be applied widely.

[0105] All or a part of programs stored in a device driver and ROM123 may be stored in record media (a floppy disk, CD-ROM, etc.), it may be distributed, and this program may be installed in a computer 11, or you may store in ROM123.

[0106]

[Effect of the Invention] High-speed preservation and read-out of data become possible, stopping an exclusive area of terminal areas, such as a computer, and maintaining compatibility with the existing record medium according to this invention, as explained above.

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[Translation done.]